www.hanback.com

LiDAR Steering SmartCar
OSEK RTOS

LiDAR Steering SmartCar OSEK RTOS is an autonomous vehicle robot equipped with LiDAR sensor and steering system based on OSEK RTOS. You can learn about LiDAR sensor and other various sensors as well as self-driving, ROS and SLAM through this equipment.

Since **1984**

HANBACK ELECTRONICS Co.,Ltd.
518 Yuseong-daero, Yuseong-Gu, Daejeon 34202, South Korea
TEL. +82-42-610-1111, 1164 (Dir.) FAX. +82-42-610-1199 E mail. overseas@hanback.co.kr

V2.0.0

IT Convergence

LiDAR Steering SmartCar **OSEK RTOS**

LiDAR Steering SmartCar OSEK RTOS
is an autonomous vehicle robot equipped with LiDAR sensor and steering system based on OSEK RTOS. You can learn about LiDAR sensor and other various sensors as well as self-driving, ROS and SLAM through this equipment.

- Supports about 20 OSEK RTOS examples and programs
- Supports priority-based real-time scheduling
- Supports CAN network technology and Cortex-M4 core for internal communication of vehicles
- LiDAR sensor for self-driving
- Robot middleware ROS (Robot Operating System) training available
- Simultaneous localization and mapping (SLAM) training available
- Multi-ultrasonic sensor for object detection
- Speed measurement using radar sensor
- Line tracing using infrared sensor
- Operating control using DC encoder motor
- Steering control using servo motor
- Intelligence control using accelerometer and gyroscope sensor
- Instruction on using real-time operating system for automobile through practical exercises
- Development tool for OS setting and utilization
- Supports standard APIs for SW developers to easily develop applications

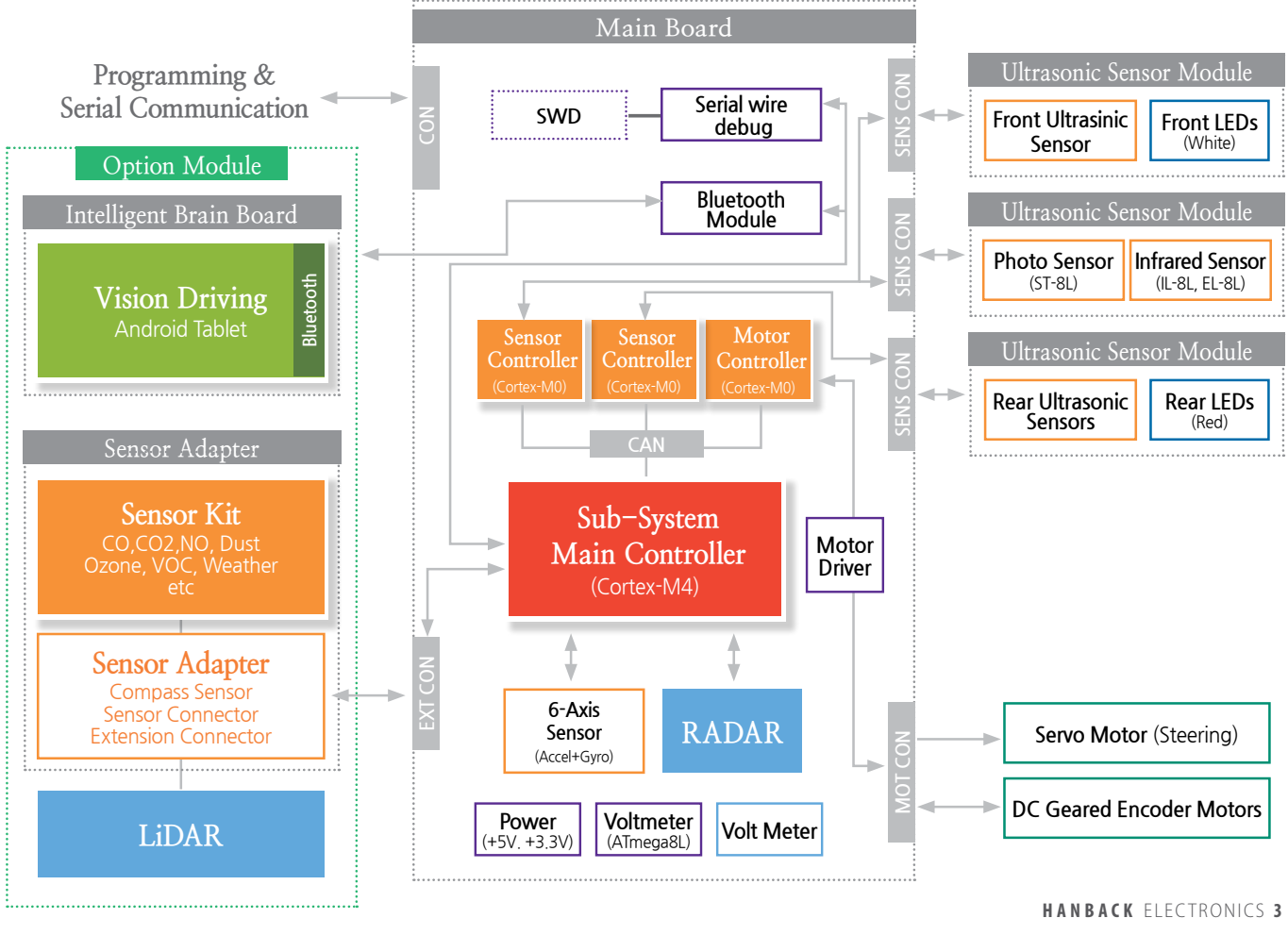
Product Overview

LiDAR Steering SmartCar OSEK RTOS was created to support the research of ICT convergence service using intelligent mobile robot based on OSEK RTOS and the training of high value human resources. With LiDAR Sensor and Steering System, you can learn LiDAR sensor and other various sensors as well as self-driving, ROS (robot operating system) and SLAM (Simultaneous localization and mapping). Designed to enable smart phone and PC to be used as robots' brains for high-performance vision processing, it combines data from acceleration, magnetic, and gyroscope sensors with vision, including 12 ultrasonic sensors and 8 infrared sensors. It can be used to develop innovative autonomous navigation algorithms and application services for mobile robots.

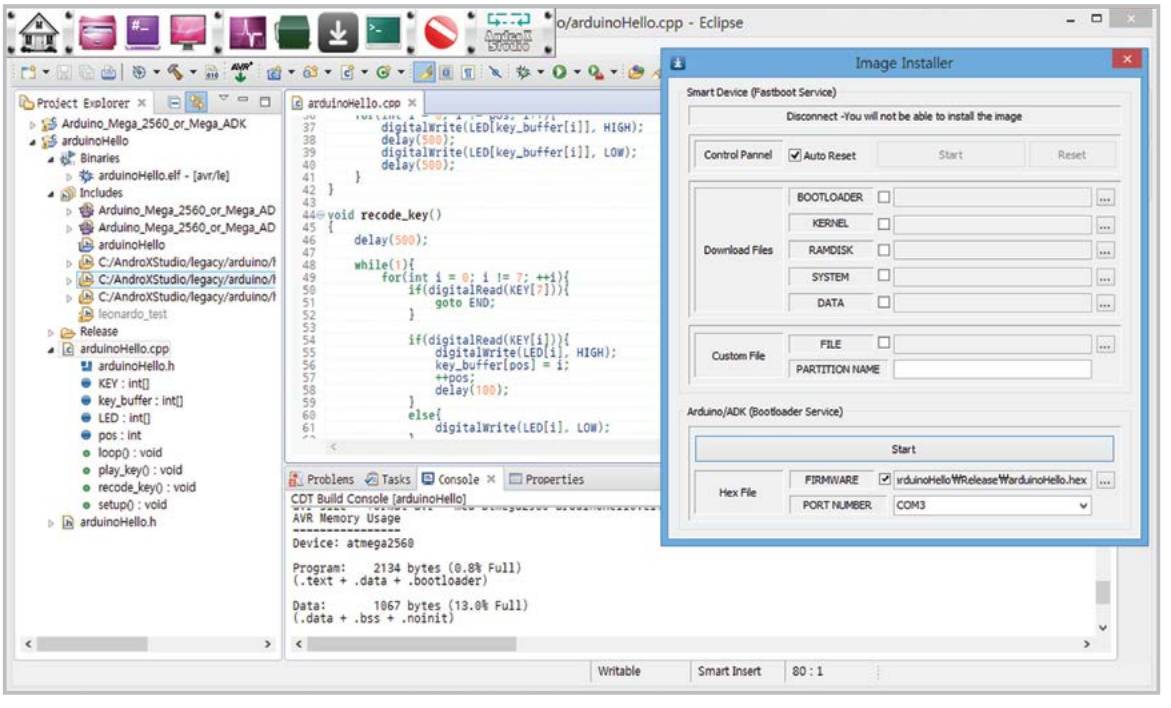
Product Features

- Based on OSEK RTOS, 32 bit micro-controller is applied and about 20 practical exercise and programs are provided.
- Priority-based real-time scheduling function is included.
- Supports CAN network technology and Cortex-M4 core for internal communication of vehicles.
- Automobile robot with LiDAR sensor that includes collision avoidance exercise and location tracking exercise to learn about ROS and SLAM.
- By supporting the ADK-based electronic device development environment, the Google Smart Device Peripheral Design Platform, you can quickly and easily develop applications that work with Smart Devices with the Google Android platform.
- With 12 ultrasonic sensors and 8 infrared sensors, obstacles can be avoided and missions can be performed on a given route.
- DC geared motor has built-in encoder, so it can detect the operation status of motor and can calculate rotation direction and speed.
- Accurate steering control using servo motor is possible and it is able to change the rotation axis of front wheel for forward direction.
- Built-in Bluetooth communication module enables remote control based on SPP profile through PC, notebook, smartphone, tablet etc. that support Bluetooth communication.
- Smart phones and tablets can be used as the brain of mobile robots, enabling the implementation of mobile robot-based ICT convergence services using high-performance processors and Wi-Fi communication environments.

Block Diagram



Integrated Development Environment AndroX Studio™



Hardware Specifications

Category	Specifications
Main Body	
Size	340mm x 600mm x 220mm
Weight	6Kg
Sub-System Main Controller	
Controller	STM32F407
Driving Clock	8MHZ
Flash Memory	1Mbyte
SRAM	192Kbyte
ADC	12bit 24channels
Debug mode	Serial wire debug (SWD)
Sub-System Sub Controller	
Controller	STM32F072
Driving Clock	8MHZ
Flash Memory	128Kbyte
SRAM	16Kbyte
ADC	12bit 16chnnels
Debug mode	Serial wire debug (SWD)
Connectivity	
Bluetooth	On-Board Bluetooth (FB155BC)
	v2.0+EDR
	SPP, A2DP, HSP

Category	Specifications
Sensor Controller	
Ultrasonic Tx Sensor	MA40S4S (40KHz / 20Vp-p) 12EA
Ultrasonic Tx Sensor	MA40S4R (40KHz / 20Vp-p) 12EA
Infrared Sensors	
Light Emitter	3mm, 940nm Infrared Emitter Diode 8EA
Receiver	3mm, Photo Transistor 8EA
6-Axis Physical Sensors	
Acceleration, Gyroscope Sensor	MPU-6050
	3-Axis MEMS Gyroscope
	3-Axis MEMS Accelerometer
Motor	
DC Motor	12V DC Geared Encoder
Servo Motor	5kg/cm at 6V, 0.14sec/0.12sec 4.8V/6V
Motor Driver	L298P
Digital Voltmeter	
Controller	ATmega8
Display	3Digit 7-segment
Sensor Adaptor	
3-Axis Compass Sensor	AK8975C
	3-Axis Electronic Compass
Sensor Connector	2x25 1.27mm Pitch Header
xpansion Connector	UART 1Port, GPIO 5EA, Power (3.3v, 5v, 12v)
Power	
Battery	NionH Battery 2400mA 8.4 Volts

RADAR Specifications

Parameter	Notes	Min	Typical	Max	Units
Frequency Setting	1	10.520	10.525	10.530	GHz
Radiated Power (EIRP)	1	12	15	20	dBM
Spurious Emission	1			-7.3	dBM
Settling Time			3	6	µSec
Received Signal Strength	2		200		µVp-p
Noise	3			5	µVrms
Antenna Beam-width (3 db) - Azimuth			80		°
Antenna Beam-width (3 db) - Elevation			40		°
Supply Voltage		4.75	5.00	5.25	VDC
Current Consumption			30	40	mA
Pulse Repetition Frequency	4		2		KHz
Pulse Width	4	10			µSec
Operating Temperature		-15		55	˚C
Weight			8		gm

RADAR Specifications

Item	Unit	Min	Typical	Max	Comments
Distance Range	Meter(m)	TBD	0.15 - 6	TBD	White objects
Angular Range	Degree	n/a	0-360	n/a	
Distance Resolution	mm	n/a	<0.5 <1% of the distance	n/a	<1.5 meters All distance range*
Angular Resolution	Degree	n/a	≤1	n/a	5.5Hz scan rate
Sample Duration	Millisecond(ms)	n/a	0.5	n/a	
Sample Frequency	Hz	n/a	≥2000	2010	
Scan Rate	Hz	1	5.5	10	Typical value is measured when LiDAR takes 360 samples per scan

Software Specifications

Category	Specifications
Robot Subsystem Arduino Firmware	
OSEK Development Environment	EmBlocks IDE, PHP, OSEK OIL generator
Functional Test Firmware	Motor / Encoder, Ultrasonic Sensor, Infrared Sensor, LED, Compass Sensor, Gyro Sensor, Accelerometer, Buzzer, UART / Bluetooth
Intelligent Robot Test Firmware	Remote Control between Smart Device and HBE-SmartCar based on Bluetooth Automatic Obstacle Avoidance using Ultrasonic Sensor Autonomous Driving that Recognizes Objects using Vision Specified Route Driving using Infrared Sensor Specified Route Driving using Encoder, Acceleration, Gyro Sensor
Robot System Vision / Service Program	
Smart Device Integrated Development Environment	AndroX Studio™
Vision Library	OpenCV for Android
Vision Application	YUV to RGB Conversion, Pixel based Image Processing, Mask based Image Processing, Color Recognition, Feature Recognition, Face Recognition, Motion Recognition
Smart Device Application	HBE-SmartCar Sensor Value Reception and Direction Remote Control Obstacle Avoidance Autonomous Driving Remote Monitor using Ultrasonic Sensor Object Recognition Autonomous Driving Monitor using Vision Specified Route Driving Monitor with Infrared Sensor Specified Route Driving Monitor with Encoder, Acceleration, Gyro Sensor Wi-Fi based Smart Device Video Real-time Reception

OSEK RTOS

OSEK RTOS provides a standard software architecture for a variety of electronic control devices in automobiles. Developed as a standard interface, application development is easy, software is portable and scalable. This saves development costs and time. In addition, there is a standard that considers the processing of system malfunctions, so that software stability can be achieved.

ROS

Robot Operating System (ROS) is robotics middleware (i.e. collection of software frameworks for robot software development). It provides services designed for heterogeneous computer cluster such as hardware abstraction, low-level device control, implementation of commonly used functionality, message-passing between processes, and package management.

SLAM

Simultaneous Localization and Mapping (SLAM) is a concept used in robotics and so on. It is a technology that the mobile robot moves around in arbitrary space, searches for the surrounding area, and maps the space and estimates the current position.